NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

INITIAL COST ESTIMATE OF OUTSOURCING INFORMATION SYSTEMS TECHNICIAN UNIVERSITY

by

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June 2000

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	June 2000	Master's Thesis

4. TITLE AND SUBTITLE
Initial Cost Estimate of Outsourcing Information Systems Technician University

5. FUNDING NUMBERS

6. AUTHOR(S)
Myers, Jerry L. Jr.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Postgraduate School
Monterey, CA 93943-5000

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(maximum 200 words)*

This thesis provides an initial cost estimate of outsourcing the academic component of the Information Technology training pipeline, designated as Information Systems Technician (IT) University. This estimate is based on a model of sending the ITs straight from recruit training to civilian community colleges throughout the country. The model builds assumptions into the conduct of this program to facilitate relative cost comparisons between the proposal and the current program.

Final results show that it would cost almost three times as much to fund this alternative program. However, discussions of excess capacity at educational institutions and total throughput reveal benefits that may justify the increased cost of an outsourced program.

14. SUBJECT TERMS
Information Systems Technician, Information Systems Technician University, Information Technology, Education Cost Estimation

15. NUMBER OF PAGES
108

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFI- CATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500

Standard Form 298(Rev. 2-89)
Prescribed by ANSI Std.

239-18

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INITIAL COST ESTIMATE OF OUTSOURCING INFORMATION SYSTEMS TECHNICIAN UNIVERSITY

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN FINANCIAL MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
June 2000

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I. INTRODUCTION

Many factors have spawned the need for a force of Information Technology (IT) professionals within the United States Navy. One factor has been the growing influence of information technology on the workplace that has occurred nationwide. As corporate America has fought to get its arms around this heterogeneous monster, so has the Department of the Navy. IT has the potential to act as a force multiplier in both how we work and how we fight. However, without the technical expertise to administer its implementation, we have been forced to rely on an outsourcing of this capability.

Another factor that has led to a need for IT professionals has been the contractionary fiscal environment in which we now exist. For example, one resource that drives naval operations to a great extent is fuel. The cost of fuels used in ships, aircraft and other vehicles often drives the tempo of naval operations. In many cases, we have no control over the outside forces that require us to expend fuel. Once deployed, management of fuel as a resource becomes subject to the whim of the next nation that chooses to threaten our national interests. However, prior to deployment, we can save money in the

training phase, through modeling and simulation. As this new budgetary need for the Navy has become more prevalent, a concurrent need for homegrown IT professionals has increased as well. The need for IT specialists to install, administer, and troubleshoot simulation systems has reached a critical point. Without this human capital, the Navy is fated to rely upon technical specialists who, while intricately familiar with the software side of the problem, have no knowledge of the war fighting side. IT personnel who are intricately familiar with our organizational structure, with all of the paradigms included in that package, gain for us the biggest bang for our IT dollar.

This thesis will conduct a cost comparison of the current method by which the Navy currently provides education and training to this core of IT specialists with a method that outsources one hundred per cent of the academic component of this program. The pilot program currently in place was established to get the Navy moving down the path towards developing IT expertise as a corporate skill. The matter of what will be the final vehicle for this effort is still open for debate. However, a look at the current program does provide an initial basis from which to propose new programs.

A. THE NAVY AND THE TECH-PREP PROGRAM

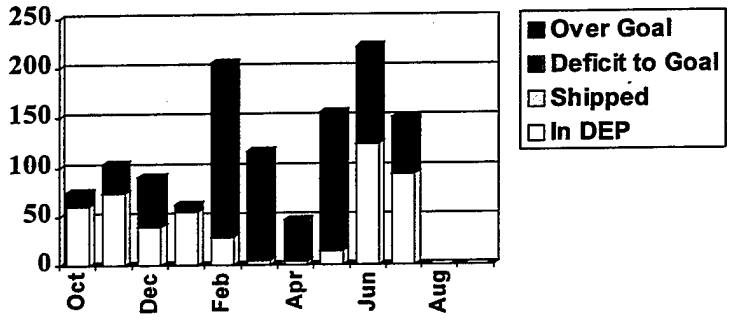
In order to deal with the shortfall in Information Technology knowledge throughout the Fleet, the Navy's first action was to redesignate Radiomen (RM) as Information Systems Technicians (IT). In conjunction with the creation of this new rating, four new Naval Education Codes (NECs) were created in order to provide IT specialists to fill specific Navy-critical requirements. Those NECs are Systems Administrator, Network Security Vulnerability Technician, Advanced Network Analyst, and Information Systems Security Manager. While a step in the right direction, an issue that continues to plague this initial solution is a shortage of qualified instructors. Few and far between are naval personnel who are certified in Novell Networks, Java Script, Windows NT, etc. While the schools for these NECs have since been established, the throughput is currently too small to meet fleet demands.

In order to cope with the shortages from the official CNET (Chief of Naval Education and Training) classrooms, many commands and activities have been authorized to contract out to local or exported certification courses provided by IT companies themselves. This situation will

only be compounded when the NMCI (Navy-Marine Corps Intranet) goes online, as the IT burden on any activity will significantly increase. While it is true that contractors will assume much of this burden, there will still be an additional load to be carried by the Navy. The graph below shows where we will be in the IT rating by the end of FY-00. DEP designates new recruits in the Delayed Entry Program, while the term "Shipped" identifies DEP members who have actually departed for initial recruit training.

FY-00 IT Posture

As of 13 September 1999



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
In DEP	60	73	39	54	29	5	3	14	123	92	0	0	492
Shipped													0
Over/Short	15	-30	-51	-68	-176	-111	-43	-141	-92	-58	0	0	-755

[From Ref.1]

An effort to counter this deficit in IT expertise is the Navy's use of the federally funded Tech-prep program, a program that supplies college-level technical classes to high-school students. Research in support of this program shows that seventy-five percent of high-school graduates today attend college within two years of graduation [Ref.1]. The increase in the number of college attendees, and more specifically community college attendees, combined with the reduction in demand for blue-collar workers and an increased demand for IT labor, has led to a sharp impingement on what was previously defined as the military's labor market for new recruits. One way to tap into the dynamics of the new labor market is to offer incentive packages that provide similar benefits to those offered by civilian businesses.

The Tech-prep program is a federally funded program spawned in much the same way that the Government Act for Science and Math Education was in the 1960s. That act was developed in response to America's need for area-specific education in order to remain a viable economic power. To this end, the government has funded the Tech-prep program at 100 million dollars a year to provide technical preparation for future college studies at the secondary

school level. A simplification of the program is that students take college courses in the IT field while still in high school, which allows them to front-load many college requirements and to achieve an Associate's Degree at an accelerated pace once they have graduated [Ref.1]. Since the high school level funding is already provided by a separate federal act and is a budgetary line item for the Department of Education, there is no money coming out of the Navy's pocket. The Navy simply capitalizes on the program's products.

This capitalization occurs by canvassing this small pool of high school and Tech-prep program graduates, and offering them a fully-funded Associate's Degree (AAS) education, as well as at least an initial career path in an IT field, as incentive for joining the Navy. After completing designated Tech-prep courses in high school, the recruit completes his general education requirements at a community college (projected to require from one to three semesters/quarters)[Ref.1]. From there, he attends Navy Recruit Training at Naval Training Center, Recruit Training Command (RTC) Great Lakes, Illinois, with an additional year and three to six months of technical training provided by the Navy. The major a portion of this time is spent at

Information Systems Technician University, or ITU, conducted at the Fleet Combat Training Center, Atlantic in Dam Neck, Virginia. Successful matriculation of ITU (approximately a one year course) leads to the awarding of an AAS in Information Systems Technology. Following completion of ITU, students then report to IT "A" School for approximately three months, also at Dam Neck, and then on to billets in the Fleet. Totaling the time allotted to complete either a three semester (one year) or three quarter (nine month) course of instruction to complete general education requirements, plus the one year and three months of additional Navy training, there exists approximately a two-and-a-half year period for a high school graduate to become a "full-up" round via this tech-prep program. In addition to this cost in time, actual fiscal cost projections are displayed below:

Approximate recurring cost for the rate sponsor for establishing the AAS degree program

- $151K for each twenty student class (approximately $7,550 per student)
  - Cost includes tuition, books, lab fees and laptop computers. No additional *college* costs will be incurred
- Additional set-up/misc. costs include:
  - Classroom config, etc...
  - Salaries and PCS move to-from FCTCL Dam Neck for the Sailors attending the instruction

[From Ref.1]

The obvious fiscal benefit of this program is that the Navy does not incur any cost until the student "chops" to the service, which occurs *after* the completion of their initial community college requirement. Between this initial tenure at a community college and advanced courses taken in high school, the student will have completed 23 credits, or 31%, of their AAS required courses [Ref.1]. However, the throughput in this program is still an issue. The pilot program class size is twenty-five; five reenlisting sailors and twenty Tech-prep students/new recruits. Future projections for Class years 01 and 02 show only twenty students per section, with the number of sections increasing to two in 01, and three in 02. Another argument

that may present itself is whether or not the money already spent on those sailors who reenlist specifically for appointment to ITU (the five listed above) should be considered a sunk cost or as a component of the total cost of the program. The initial pilot program has no Tech-prep students, and so all of the attendees require a full course load in order to satisfy requirements for the AAS degree. Tech-prep students will begin entering the program in Calendar Year (CY) 01.

While this program clearly has merits, it also possesses some significant shortfalls. Chapter Two will present an alternative method of providing the same end product.

B. SCOPE OF THIS WORK

This thesis provides an initial cost estimate of outsourcing the academic component of the IT training pipeline, or ITU. This estimate will be based on a model of sending the ITs straight from recruit training to civilian community colleges throughout the country. The model will also build some assumptions into the conduct of this program in order for relative cost comparisons between the proposal and the current program to be reasonably accurate.

Some of the secondary questions this thesis will briefly discuss are:

- The cost of current substitutes for formal IT training;
- The financial dynamics specific to the education industry that would have an impact on the final cost of a possible contract;
- Advantages and disadvantages of the in-house program versus an outsource program.

Chapter II will present the alternative to ITU, and discuss some aspects of the literature completed in support of this thesis. It will also provide the parameters for the cost model, and define the assumptions made in the cost estimation process. Chapter III will apply the assumptions set in Chapter II to produce projection figures for the alternative. It will also discuss some of the advantages and disadvantages to the stakeholders in a possible contract for this option. Chapter IV compares the costs of ITU with the estimates developed in Chapter III. Chapter V concludes this work with a look at what was accomplished and the issues outstanding.

II. METHODOLOGY AND COST MODELS FOR COMPARISON

A. ITU AND ITS OUTSOURCE ALTERNATIVE

Before proceeding any further, it is necessary to outline at least some of the basic tenets of the proposed alternative. Currently IT University is taught at Dam Neck Virginia. Students receive approximately sixty-three credit hours of college-level instruction in a program that resembles many Information Systems Technology programs that can be found at other community colleges throughout the country [App.1] Students are berthed in the Bachelor Enlisted Quarters on the Dam Neck Naval Base and have access to the base galley. The program lasts roughly one year, and students then proceed "across the street", to Information Systems Technician "A" School, for Navy and fleet-specific training prior to reporting to their first operational tours of duty, most of which will be at sea.

The alternative to this program that this thesis proposes involves an outsourcing of the AAS-degree component to a community college, preferably a college that owns multiple campuses. The reasons for desiring a multiple-campus college are: (a) to increase program throughput, and (b) to reduce government exposure to risk of cost inflation by limiting the impact of the primary

cost driver in this program alternative. This primary cost driver is personnel, specifically the hiring of any additional teaching staff. It is possible to execute this program on campuses by using their excess capacity, but only if the size of the ITU additions are kept within the limits of that excess capacity. Where it is not possible to execute this program via a single-source contractor, this thesis will also look at the possibility of a multiple-source, single contract option.

The current throughput for ITU for the March 2000 through March 2001 class is twenty-five. Projections for the 2001 to 2002 class are for forty students, with another sixty in the 2002 to 2003 class. In order to gain an increase in throughput, which would give the proposed program alternative a reasonable advantage over ITU, the model presented throughout this thesis assumes class sizes of twenty-five at each of four separate sites, either all owned by the same college organization, or individual properties. Since it is impossible to determine exactly what various colleges have for current and projected excess capacity, and in order to make direct comparisons to ITU's current class size, an identical student-body size of twenty-five was chosen. This assumption leaves a reasonable

safety-zone for margin of error, and facilitates ease in making direct cost comparisons to the current and proposed programs. More detail on assumptions is provided at the end of this chapter. For the sake of brevity, this program alternative, the outsourcing of an AAS-program for the IT-rating, is hereafter referred to as Outsourced ITU, or OITU.

B. THEORY OF EXCESS CAPACITY AT EDUCATIONAL INSTITUTIONS

This thesis and the cost estimations are predicated on the theory of excess capacity at academic institutions. Gibson's work at the University of Colorado presents a working model of this theory [Ref.2]. There are two constraints to an institution's capacity in terms of how many students may be taught in a given period of time. One is the actual physical constraint, not so much in size of the facilities, but in the number of hours those facilities are used. It is true that a community college should have a significant amount of physical excess capacity, as they have a large percentage of students who attend at night. However, capturing this physical excess capacity may not be economically viable. To increase the number of hours the physical facility is used would require the hiring of

additional teaching staff in order to actually teach *more* sections of a given course [Ref.2]. As stated above, this is the cost increase that must be avoided in OITU.

Gibson proposes another theory of capacity in two senses. The first defines excess capacity in a "pedagogic" sense, where excess capacity is referred to as " the maximum allowable section size for each course."[Ref.2] The second redefines capacity in a "physical" sense as the maximum number of students that can be accommodated in the room where the course is taught. Since the former is typically more restraining than the latter, the model for OITU is primarily concerned with remaining within the pedagogic boundaries of the school's excess capacity. Under this premise, a section with a maximum teachable capacity of thirty-five students that only had thirty students enrolled would have a pedagogic excess capacity of five. A major vein of the discussion here will cover the cost savings, as well as possible risks involved, in capturing and remaining within the bounds of this excess student capacity at whichever institution would be selected to service this program.

C. COSTS INCURRED UP TO THE START OF IT EDUCATION

Regardless of which of the two alternatives the Navy chooses to pursue, there will be certain costs incurred up to the point of the start of IT education. In both the current program and OITU, those costs incurred from recruit induction at one end of the pipe to graduation from Recruit Training Command (RTC), Great Lakes, IL are the same. These costs include:

- All costs incurred in the recruiting process;
- Transit for the recruit from home of record to Recruit Training Center, Great Lakes, IL;
- Costs incurred during the normal recruit-training pipeline at RTC Great Lakes;

These cost are assumed to be equal because they are constant across the two options.

D. DIFFERENTIAL TRANSPORTION COSTS

Cost differentiation begins at the graduation point, primarily due to the divergence in transit costs. For the current program, travel costs incurred are from RTC Great Lakes to Dam Neck, Virginia. Travel occurs via commercial means and each graduate from RTC Great Lakes makes his/her

own travel arrangements with the travel office in order to make arrangements for leave and transit. Because the OITU model will increase throughput, a charge is applied to the cost estimate for this increased total travel volume. This charge is based on estimated travel costs for an additional 75 students. The cost of those students taking POV transportation to their next duty station is zeroed out in the cost comparison. There are no data to support that any rating is *more* likely to take POV transportation than any other.

The OITU costs for travel are developed using a commercial air-travel model. Since it is impossible to tell what schools would be awarded a contract if this program were outsourced, an average cost of commercial transit is determined for cost comparison. It is not realistic to presume that the travel could also be accomplished using organic naval air assets, so commercial air travel is the assumed mode of transit. The average transit cost uses average air travel costs from Chicago, IL to points within a one thousand mile radius, which provides sufficient coverage of the continental United States. It is true that RTC Great Lakes' geographic position, lying approximately one-third of the distance from the east coast to the west

coast, would require greater travel distances to points on the west coast. Therefore west coast travel would break the one-thousand mile radius used to estimate travel costs. However a greater number of the possible sites for OITU lie within that one thousand mile radius, with only a few being outside of it. For this reason, the one thousand mile radius is maintained as a good point of reference from which to make the cost estimations for travel.

There is also a charge applied for transit from air-arrival facilities to the point of berthing for the OITU students. This charge is applied due to the differences in arrival procedures at a military training command area, such as the current ITU program, and a non-military area. At the Dam Neck program, Information Systems Techs will be picked up via US Navy organic assets. In OITU, this transportation will be commercial. Average taxi costs for transit from airport to hotel for American business travelers are used here. Since these data are not readily available as a national average, the average cab fare in New York City is used as a close estimate [Ref. 3]. This data point will provide the "worst case" cost due to New York City's high cost of living. The cost of van transport in the Dam Neck program is considered zero. There is an

argument that could be made that the costs associated with the operation and maintenance of the van should be included in the total cost of the Dam Neck program. The reason it is not included is that the van comes from a common pool of base vehicles and is the base duty van. As the input of IT University students will only require, at face value, two to four additional pick-up trips to Norfolk International Airport, Norfolk, VA per year. The increase in already incurred costs is considered negligible. Furthermore, the costs of the van are shared by all of the tenet commands of the Dam Neck base, further reducing the burden on any single program.

Based on the data obtained [Refs.3 and 4], the increase in *relative* costs incurred by the Navy up to the point of commencement of IT education if implementing OITU are calculated as follows:

Formula 1-1: Additional Travel Costs Due to Higher Throughput in OITU

Average Cost of Commercial Air Travel + Cost of Arrival Transit to Berthing = additional relative costs incurred

[Average Air Travel Costs/1000mi. trip + (average cab fare) +(average cab fare x inflation rate)] x 75 students = [325.81 + (6.60+ (6.60x0.02325)] x 75 = $29,942

Cost of air travel is given as standard commercial costs, not in government rates. There is no inflationary rate applied to average air travel costs since the data are from the period ending March 2000. Any impact from two months of inflation is negligible. The inflationary rate applied to the average cab fare is the average annual inflation rate for the period 1996 to 1999 [Ref.5]. The final result represents the additional $29,942 the Navy would pay in transit costs for OITU relative to ITU.

While it is realized that the costs of berthing will also be a cause for price differentiation in the two programs, that cost is included later in the total cost of the actual IT education program alternatives. This is due to the assumption that entrance into berthing will, in most cases, be nearly coincident with the commencement of IT education. So it is not grouped here with the costs that are incurred *prior to* commencement of IT education.

E. COST SAVINGS PREDICTIONS OF THE OITU MODEL

1. Single Source Versus Multi-Source

The discussion of a cost comparison between the one-hundred percent outsourcing of the IT's education versus the current pilot program would be incomplete without some attention given to the factors involved in a single-source versus a multi-source contracted service program. To this point, this section will briefly discuss some of the trade-offs that may or may not be captured in the two alternatives. The use of the term multi-source should be differentiated in this discussion from its typical contractual connotation. In the contracting definition, multi-source versus single-source refers to the method of competition that is enjoined in order to determine the provider of a program. In single-source there is only one contractor approached to determine the details of program procurement. In contrast, multi-source contract procurement involves opening a bid for a specific procurement contract to multiple contractors, thereby capturing cost savings by making the final cost figure of procurement a competition between the entrants to reach the lowest, realistically achievable price. In this thesis, the term "multi-source" is used to represent the fact that the OITU model pursues a

higher program throughput by seeking establishment of an IT university at several community colleges, not just one location. In the case of the current pilot program, it is "single-source" in that it is established in one location, with one organization acting as the primary service provider. This thesis' use of the term is more akin to US Navy shipbuilding programs that procure units of ship classes from multiple shipyards.

The immediate gain of going to a multiple site service program for the education of Information Systems Technicians is the increased throughput. The current pilot program is set up to handle a total of twenty-five students, twenty of which are new accessions to the United States Navy and an additional five sailors returning from initial sea tours. By shifting to a multiple source education service contract, this throughput could obviously be increased. The cost estimation model of this thesis will assume a four-site multi-source service contract, each using the same number of students currently enrolled in the pilot program, for a total throughput of one hundred students per graduation cycle. The class-size assumption is set as identical to the pilot program in order to prevent

the entry of any arguments pertaining to cost increases that could be incurred due to a greater class size.

Beyond this increased throughput there is precious little cost advantage to having the program taught via multiple sources. There are several *indirectly* related advantages (opportunities for distance learning, greater flexibility, redundancy factor, etc.). However, they are not directly relevant to this case study. The more important and relevant cost differences will come from the dynamic of a total outsourcing of the program, versus the "one-half civilian, one-half military" service structure of the current pilot.

2. Cost Consequences of Personnel and Core Competencies

The best opportunity for capturing cost savings in the OITU model is in the area of cost for personnel. The current pilot program, ITU, employs a number of civilian personnel as well as a number of active-duty naval personnel. Hence one cost savings of the current pilot is that the component cost of the military personnel is not a direct cost to the program manager. The program, by employing active duty military personnel to satisfy its

requirements for total personnel staffing, has thereby created a *relative* cost savings to the program, when it is considered that this requirement would otherwise be met fully with civilian labor, which would increase the direct charges to the program manager.

OITU would lack this cost savings aspect. There would only be civilians. The pay for these civilians would be a direct cost to the policy manager. OITU would, however, gain the benefit of going to a source for whom the provision of Associate's Degree-level education is a core competency. There are almost innumerable cost savings here, but this point opens the controversy of the appropriateness of learning curve theory application to the service provider. An argument can be made that there is a learning curve savings that would be captured in selection of the core competency organization for service provision (OITU). There is also weight in the point that there would be a certain benefit to be gained by having naval personnel instructing and supervising new naval service members (ITU). In fact *this* very advantage is why active-duty and retired naval personnel are sent as instructors to both the Naval Academy and the Naval Postgraduate School. There is a further point that there could be a great deal lost in

having new naval service members instructed only by civilian personnel, who would have no sense of the cultural issues specific to military service. This thesis proposes that this is one of the very reasons for home-growing our own IT professionals in the first place. This absence of cultural knowledge is sure to cause some shortcoming in the early years of a totally civilian taught program, which the Navy would eventually have to unearth and correct as program changes in future years. This need to adjust OITU as a production process means that it is applicable to apply gains and losses due to learning curve theory to this program as well. In the same vein, there is an argument that some efficiencies and effectiveness are lost in the current program being taught by personnel for whom the academic education of students is not a core competency. The point here is that there would be some initial loss between actual program output and maximum potential program output in the early years of *both* program alternatives. The question comes in determining *which* learning curve is the most shallow and therefore costs the Navy the most in applied resources.

3. Elimination of Payback

A definite personnel gain that is captured by one hundred percent outsourcing, however, is the elimination of the need to recapitalize personnel from the pool of program graduates. In the current program, a certain number of the graduates are immediately recycled into a mentor/instructor pool. The current view is that this function will be fulfilled by the five class-members who are returning from initial sea tours. Upon graduation, these five sailors will remain at Fleet Combat Training Center (FCTC) Atlantic, Dam Neck, and act as mentors to the ITU students, instructor assistants at ITU, and aid in course implementation of other IT-courses taught at FCTC Atlantic. In future classes, this number will have to increase in order to provide sufficient bodies to allow for program growth and eventual greater throughput, specifically at ITU, and perhaps for other programs as well. By going to a totally outsourced program, this need is eliminated, as the educational institution will provide all instructors mentors, etc. Recapitilization of human capital becomes a service provider responsibility. This also further reduces exposure to risk for the government by shifting more responsibility on to the shoulders of the contractor.

4. Material Recapitalization

The final discussion of possible realized savings or cost increases via outsourcing this program is in the area of material. This area may prove to zero itself out, with no advantage to be gained by either alternative. The easy argument to make is that the current pilot program incurs an infrastructure cost by providing the building and all utility costs thereof [App.2]. The costs of this building include cost of facilities, the greatest being the computer labs and services. Long-term costs become a significant concern when it is realized that all of these capital investments will then have to be recapitalized as facilities reach the end of their service lives. These costs could become crippling when considering the rapid turnover in information technology hardware, and the exorbitant costs of multiple-site software licenses. Costs of building maintenance are a relatively small issue, as these costs will be accounted for as part of the total maintenance costs for the Dam Neck base. However, the cost to retain maintenance personnel for the IT facilities is borne solely by the program. Clearly, none of these cost are directly borne by the program when outsourced, however

there will be a significant increase in husbanding services for naval personnel enrolled at civilian institutions. These personnel will have to be berthed in non-military housing, requiring the payout of housing allowances, as well as subsistence. These costs, which are only marginal for the Dam Neck base, may negate any savings realized by OITU having no direct responsibility for infrastructure.

F. MODEL ASSUMPTIONS AND LIMITATIONS

While many of these assumptions have been stated before, this section will present them all in one place, as well as cover some of the limitations of the model as to what it is incapable of capturing. In order to set all alternatives equal and select a practical point from which to draw conclusions and show relative cost differentials, the following assumptions are made in development of the cost-comparison model between ITU and OITU:

1. Class Size: Class size is assumed to be equal (twenty-five) across both alternatives. This is to prevent the entrance of any arguments of cost and/or quality differences developed from larger class sizes.

2. Travel Distances: The airline data shown in formula 1-1 show distances of one thousand miles. Since a radius of one thousand miles would permit travel to most points within the contiguous United States, this figure is considered acceptable.

3. Site Location: Location is determined independently and not selected based on cost. Location is a product of consideration of sources exemplifying other characteristics required to satisfy the model, specifically probability of excess capacity, and having a current IT program in action.

4. Excess Capacity: It is assumed that, with the relatively small class sizes, one of the costs that will be zeroed out is the cost of hiring any additional civilian personnel as instructors at the sites for OITU. In order to have a program that is realistically capable of being implemented within fiscal constraints, this requirement is imposed so that no funds will be expended to hire additional civilian personnel as instructors by the service

provider, and therefore that class sizes must be of a size small enough that the commercial institution would be able to meet the program needs using their excess capacity. This also acts as a positive trade-off between the colleges and the Navy, as the Navy would be providing a use for capacity that the colleges must maintain, but are presently not using.

5. Housing: It is assumed that all attendees will live off the economy in the local area, and therefore will require funds for housing and subsistence. This assumption is made because there is no justifiable way of determining what percentage of ITU students will have dependents or not, or whether campuses will have sufficient housing for the additional students on their grounds.

G. CHAPTER II REVIEW

The cost estimates found later in this thesis, are only valid within the model constraints delineated in this chapter. The theory of excess capacity is central to this model. Any service structure which fails to capitalize on this theory will present costs that go far and beyond what

is presented herein. By taking advantage of the theory of excess capacity as it relates to education, the primary cost driver is kept under control. Since instructor labor is the greatest cost driver in the education industry, then making it the central point of cost control efforts will yield the greatest results. The additional travel costs will be applied at the end of the cost analysis to the total cost of the contract. Chapter III will determine amounts for education, berthing, and subsistence. In doing so, the thesis will begin to determine whether or not the predictions discussed in this chapter are true or false.

III. DEVELOPMENT OF COST ESTIMATION FIGURES

A. COSTS OF COMPARATIVE EDUCATION PROGRAMS

1. Computer-Based Training

Neither the Army nor the Air Force has taken steps similar to the Navy's in relation to developing "Bureau mandated" Information Systems Technicians as a specialty and further requiring those personnel or some component of them to possess an Associate's Degree or equivalent. Both of the sister services have addressed their need for IT training via in-school training at service schools for currently existing specialties. That training is augmented across all service-members through a Computer Based Training program, or CBT, which both services have procured[Ref.6]. While the costs of these programs are clearly less than what the Navy will incur regardless of which alternative it pursues, neither of these methods would satisfy the Navy's need for software-engineering level technical personnel. In fact, the Navy itself has already invested a significant amount of dollars in CBT, as well, as a preliminary means of meeting our need for information systems experts [Ref.6]. In summary, all three of the military departments have online and operational CBTs which service members may enroll in and receive

instruction in order to satisfy requirements for various IT certifications such as MSCE (Microsoft Certified Engineer), Novell Systems Administrator, and CISCO Network Administrator. All of these courses take a distance-learning approach and are encapsulated completely online, usually through some partnership with a university that teaches the identical courses on-campus.

2. Locally Contracted Courses

In addition to the online resources, all services often allow commands to use training funds to send command members to locally taught courses. In this event, training is limited to the core competency required by virtue of that person's billet. Hence various members of the command may be sent to a singular night course to be instructed on how to be a system administrator or to receive a specific certification level. There is a significant cost loss, not only to the local command but to the service, because the person's follow-on orders are not arranged with any regard to IT certifications that they received by way of their assignment to the previous command. Furthermore, the individual relief for that person may not be the next one assigned whatever IT collateral duty their predecessor was

assigned. The Commanding Officer of the facility is more likely to assign the IT collateral to someone with whom he/she is familiar. It then follows that the new individual will have already completed a portion of his/her tour. So when the command sends this next individual to an outsourced school, this person will depart after less than a full tour of duty.

In order to understand the costs involved in how the other services are addressing their IT needs, as well the money that the Navy is losing in its efforts to meet its IT needs, we must look at the typical costs of education for some of the more highly demanded IT courses in the country and those specific to the services needs. Three of the most highly sought IT courses for the military are Windows NT Systems Administrator, Microsoft Certified Systems Engineer (MCSE), and Certified Novell Administrator (CNA). If an individual were to order all of the course materials and take all of the exams, the most expensive of these certifications could cost as much as ten thousand dollars. Carrier Battle Groups have spent as much as $40,000 sending sailors to commercially procured IT training [Ref. 7]

Since these courses are arranged by individual commands and often are arranged as open purchases and not direct

government contracts, they receive no reductions in cost due to bulk service contracts, etc. If each of the 26 naval shore-installations were to outsource one of these courses for just one systems administrator, the costs could climb to two-hundred and sixty-thousand dollars.

Most naval ratings are on a 5-year/3 year sea-to-shore rotation. Assuming that the one of the previous arguments is entered (that a command is not going to send an unknown quantity to a civilian purchased school, but will rather send someone with whom they are familiar), it then becomes likely that this training will have to be recapitalized every one-and-a-half to two years. (Example: Sailor reports to command. Command only sends those to outsourced training that have been onboard for at least a year. By the time the individual graduates from the course and returns to the command, he/she only has a year-and-a-half to two years remaining until they are to transfer).

A final consideration concerns the CBT programs each service runs. When all of these sites are viewed simultaneously, it can be seen that a large portion of their content is redundant. Yet, each service runs their own. Furthermore, each site has a statement, usually in their "Who can enroll" section or other guide to

enrollment, that lets members of different services know they are not eligible to enroll in said program. There is a significant cost to the military as a whole as it seems there are three sites up which replicate the same purpose.

B. COST ESTIMATION OF MATRICULATING OITU

It is difficult to estimate the exact costs of such a program to the Navy. In the simplest form, this program's costs will be the total cost of education (tuition and classes), plus the housing, berthing and subsistence costs of stationing our sailors at various points in the country. There is an issue here as to the uncertainty, which will surround any of these cost estimates due to a certain degree of randomness that will be associated with determining the exact locales of these programs.

1. OITU Model Sourcing Options

It is simplest to address what is known before we deal with what may or may not be unknown. The estimates for the costs of tuition and classes are based on a certain number of assumptions. The primary assumption is that, to negotiate a single contract with an institution that is capable of supporting several sites, it is preferable to

have a single, multi-site education facility. However, these types of organizations are few and far between. The one corporation found which runs campuses in several different locations nationally was used to develop cost estimates. A second option would then be to negotiate one contract with multiple sources, or four individual contracts, one contract per source. The cost estimates provided herein will cover the first two options: single-source, multi-site, and single-contract, multiple source. These cost estimates are separated and calculated individually because the cost figures of the national chain would radically skew the data if mixed with the other example. The national chain is run using a different format than most of the community colleges and so has costs on a different scale. Still, it is useful to consider this chain in that it may be impossible to negotiate a contract to the Navy's liking from multiple-sources.

2. Education Cost (Tuition Plus Classes) Estimate

Because much of the cost data used in the comparison to ITU is proprietary, no actual college names are used in this comparison. The purpose of this calculation is to give an example of what is possible should these alternatives be

pursued, not to identify hard numbers. In order to develop cost estimations of classes and tuition, we take the example class and tuition charges for the sample sources selected as follows:

School 1: national chain of college campuses with sixteen sites

Schools Two through Six were chosen by conducting an online search for the largest community colleges by population in the country using the Ulink search engine. Ulink is the largest site in the Internet that holds a searchable database of institutes of higher education. The returned names indicated two campuses in the Northeast United States, two in the Midwest, and one on the Pacific Coast. Of these colleges, School Two has four available campuses, and School Six has three sites. Although these sites are all located within one state, it still presents the possibility of capturing savings via the use of the campuses excess capacity.

	Tuition	*Class Hour Charge*
School 1	4700	290

School 2	0	67
School 3	0	82
School 4	2350	0
School 5	220	11
School 6	873	0

In cases where there are no listings for "class hour charge", the school charges a flat rate up to a maximum of 19 credit hours.

Each of these institutions hosts a program of instruction similar to the course requirements for ITU. The cost estimation for School 1 is maintained separately throughout. For Schools Two through Six however, some method of determining an expected value of source competition between the candidates is used to provide the cost estimate. If we assume, at this point that each of these institutions has an equal percentage chance of being accepted as the award recipient for the Outsourced ITU, then the contractual estimate is taken as the expected value of the five values times their probability of selection, shown in the formula presentation set below:

Formula 3-1: Expected Value of Education Costs, Single Contract, Multiple Source Option

$$\mu = E(X) = (i, N)\Sigma\ X_i\ P(X_i)$$

$\mu = E(x)$ = expected value of a discrete random variable

N = maximum number of possible outcomes of X

Where X_i is the *i*th outcome of X, and $P(X_i)$ is the probability of occurrence of the outcome of X

Because the course of instruction at ITU is set at sixty-three hours of instruction, this same figure is used to compute cost estimates for classes.

$$\therefore \mu = (67 \times 63)(0.2) + (82 \times 63)(0.2) + 2350(0.2) + [220 + (11 \times 63)](0.2) + 873(0.2) \approx \$2705/\text{student}$$

Therefore cost estimates are $2705/student using the single contract, multi-source option, and $22,970/student using the single-source, single-contract (School 1) option.

3. Housing Cost Estimation

The determination of the expected value for housing is a little more complicated, or at least there are more data

points to take into consideration. In order to do so, we look at the BHA (Basic Housing Allowance) that would be paid to service members at each of the possible sites of the six service contractors listed above. First, an aggregate rank must be agreed on for the service members. As stated in Chapter II, the use of OITU eliminates the need to recapitalize a certain number of the class members as instructors. This, in the author's opinion, eliminates the need to recycle currently serving fleet members back to FCTC Atlantic. Therefore, the student body of OITU will not consist of any NCO's (Non-Commissioned Officers), but only new recruits. A certain number of graduates from RTC Great Lakes are accelerated in rank, typically due to years spent in JROTC (Junior Reserve Officers Training Corps) during their high school years. In addition to this acceleration, there are also performance incentives for recruits to be quickly advanced to E-3 due to such awards as Honor Graduate from Boot Camp, etc. For the purposes of cost estimation of housing and subsistence, this model assumes that all students of OITU are E-2s. This will provide a figure within a median range that should approximate the costs reasonably well.

The total cost for a year's worth of berthing using current BAH rates for each of the college sites are given below. Each figure represents a single student. Costs for berthing at each of the different campuses for Schools Two and Six were equal. The Basic Allowance for Housing figure that was used for an individual location was the average of the allowances for "with dependents" and "without dependents".

Table 3-1

Yearly Housing Costs Per Individual Program Site

School 1

Site	1yr E-2 BAH
1	9,780
2	10,632
3	10,632
4	10,632
5	6,828
6	6,972
7	5,538
8	9,810
9	9,810
10	9,810
11	5,226
12	9,174
13	9,414
14	8,376
15	8,376
16	6,516

School 2:	6,408
School 3:	6,954
School 4:	11,802
School 5:	11,988
School 6:	7,224

In order to develop an effective berthing cost estimate, it is necessary to go back to the original assumption that the probability, at this point, that each of the colleges will be the one selected is equal. Since some of the colleges contain more sites than others, it is not accurate to state that the probability of the program being located at each *site* is equal. The probability of the program being located at a particular site must also account for the probability of particular school's selection. From this supposition, a probability must be assigned to the possibility of the program being located at each of that school's sites. Once that college is selected as the service provider, it is assumed that the probability of the program being located at any of that school's sites is equal between sites.

The number of sites for each school and the appropriate percentage chance that the program would be held at any of those sites is given in the table below. Again, the probabilities are calculated for School One by

itself, while the probabilities for Schools Two through Six are calculated as a group. The probability that the program would be held at any one of the sixteen sites of School One is the total probability (1) divided by the number of sites:

Formula 3-2: Probability of Program Occurrence at Any One Site, School 1 Option

Any site, School 1: P (x) = 1/16 = 0.0625

The probability of occurrence of the program at a campus of a particular school is simply one divided by the total number of campuses owned by that school. The probability that the program would be held at any one site of a particular school for Schools Two through Six is then the probability of that school's selection, multiplied by the probability of program occurrence at a campus owned by that one school.

Formula 3-3: School 2 through School 6, Probability of Program Occurrence at Any One Site Across All 5 Schools in the Option:

$$P(X, Y)_2 = (0.2)(0.25) = 0.05$$

$P\ (X,Y)_3 = (0.2)(1) = 0.2$

$P(X,Y)_4 = (0.2)(1) = 0.2$

$P(X,Y)_5 = (0.2)(1) = 0.2$

$P(X,Y)_6 = (0.2)(0.3333) = 0.0667$

From these probabilities, expected values are determined using the same formula from the tuition calculations. Because the costs of berthing for Schools Two and Six are equal regardless of campus, they can be treated as one possibility instead of separate ones.

Formula 3-4: Expected Value, Total Cost of Berthing, School 1 Option

$$\mu = E(X) = (i,N)\Sigma\ X_i\ P(X_i)$$

($\mu = E(x)$ = expected value of a discrete random variable

N = maximum number of possible outcomes of X

Where X_i is the *i*th outcome of X, and P (X_i) is the probability of occurrence of the outcome of X)

$$\therefore \mu = (9780)(0.0625) + [3(10,632)(0.0625)] + (6828)(0.0625) + (6972)(0.0625) + (5538)(0.0625) + [3(9810)(0.0625)] +$$

(5226)(0.0625) + (9174)(0.0625) + (9414)(0.0625) +

[2(8376)(0.0625)] + (6516)(0.0625) ≈ $8595/student

Expected Value, Total Cost of Berthing, Schools 2 through 6 Option

Schools 2 through 6:

$\mu = E(X) = (i,N)\Sigma\ X_i\ P(X_i)$

(μ = E(x) = expected value of a discrete random variable

N = maximum number of possible outcomes of X

Where X_i is the *i*th outcome of X, and P (X_i) is the probability of occurrence of the outcome of X)

$\therefore\ \mu$ **= (0.2)(6408) + (0.2)(6954) + (0.2)(11802) +**

(0.2)(11988) + (0.2)(7224) ≈ $8875/student

4. Subsistence Cost Estimation

Subsistence rates are constant with respect to geographic location. The rates used are for full subsistence for a standard calendar year.

Formula 3-5: Total Cost, Basic Allowance for Subsistence

BAS for 1 year/student = (BAS daily rate) x 365 days = ($8.54/day) x 365 days = $3117.10/student

5. Total Cost Estimation

By combining these expected values, we now have the initial cost estimate of education, berthing, and subsistence for an OITU:

Formula 3-6: Total Cost Estimation, Education, Berthing and Subsistence, School 1, and Schools 2 Through 6

Single-source, single contract (School 1)

(Education + berthing + subsistence) = ($\mu_{education}$ + $\mu_{berthing}$ + $\mu_{subsistence}$) = (22,970 + 8595 + 3117) = $34,682/student

Total (100 students) = $3,468,200

Single-contract, Multi-source (Schools 2-6)

(Education + berthing + subsistence) = ($\mu_{education}$ + $\mu_{berthing}$ + $\mu_{subsistence}$) = (2705 + 8875 + 3117) = $14,697/student

Total (100 students) = $1,469,700

C. POSSIBLE NEGATIVE ADJUSTMENTS TO COST ESTIMATES DUE TO BENEFITS TO THE INSTITUTION

Due to various aspects of the finances peculiar to education and educational institutions, there are several possible cost savings scenarios associated with this type of program, especially where the subject of excess capacity is concerned. Where there are potential benefits to be gained by the institution, at least some equitable portion of those benefits to the institution should be realized by the US Navy as a cost savings applied to the total cost of the service contract.

1. Volume Effect on Cost

The unit of output focused on in this analysis is the student credit hour. If the output of an educational institution and of an educational program is taken to be educated students, the one way in which to quantify that is in student credit hours (SCH)[Ref.2]. This is a standard accepted by most of the financial world for determining the output, and therefore the costs, of an educational institution. As the total costs of any single institution are computed, that institution can also determine its total output in terms of SCH for any particular unit of time.

Gibson's work at the University of Colorado allocates those costs across the various departments and functional areas using an activity-based method, which applies the costs of various functions shared by all departments by the portion of total SCH that department produces. By this method it is possible to determine the average cost per SCH for an entire institution.

The immediate advantage to utilizing excess capacity at a college is that it lowers this average cost per student hour. While the college will experience a marginal increase in the total cost to pick up twenty-five extra students, this will widen the unit base upon which the cost per average SCH is computed. This, in effect, reduces the average price it costs the school per unit of output, and in the long run, will produce increased profits for the college [Ref.2].

To see how this might have an impact on the negotiated price of the service contract for OITU, it is necessary to look at the cost to a college of an enrollment in a particular major and not average cost per student credit hour. Because of the fact there are attendees from other curricula in various classes offered by any particular department, to look at the impact on a SCH would produce a

diluted result. Our students will only be attending courses offered by the particular IT or Computer Science (CS) department since all of their AAS Core courses will have been accomplished prior to entry to the Navy. It is therefore more appropriate to look at their possible impact on the average cost per enrollment to the college's IT or CS department.

Cost data of this nature are, of course, proprietary and difficult to obtain, and so this example simply highlights the possible impact on the service contract negotiated price. One of the schools considered a realistic possibility for contract award will be used as an example. The total enrollment in their IT curriculum across all of its sites averages 234 students. If it were assumed that this represents 77% of their total capacity (the figure from which Mr. Gibson's work was based)[Ref.2], then increasing their total enrollment by twenty-five students would represent a 8% increase in their enrollment, increasing the utilization rate of their total capacity to 85% cent. For the sake of attempting to draw a reasonable parallel for this example, the use of the General Engineering (GE) line item data from Mr. Gibson's work is most applicable for this comparison. In this department,

Gibson determined that if the GE department could increase its enrollment to full capacity, it would reduce the cost of an enrollment by 10.06%. The appropriate figures are given below:

Formula 3-7: Example of Cost Savings in Cost Per Enrollment Through Use of Excess Capacity

(Cost per enrollment @ 77% capacity) - (cost per enrollment @ full capacity)/(cost per enrollment @ 77% capacity) x 100 = percentage reduction of cost of an average enrollment

{[(102.90) - (92.55)]/102.90} x 100 = 10.06%

Assuming a linear relationship between increasing student enrollment and the cost savings calculated above, the potential savings to the school in this example would be:

(10.06% reduction in cost per enrollment/23% increase in enrollment) x 8% increase in capacity utilization by accepting 25 OITU students = 3.49% percentage reduction of cost of an average enrollment in this example

The term "enrollment" is taken to be the average cost to the institution to get a student in the door as an applicant and out the door of the university as an undergraduate. From this work, it can be seen that the IT/CS department of the selected university may realize a 3.49% decrease in cost per enrollment, which will of course apply to their non-military students as well, providing a real cost savings in terms of greater utilization of excess capacity.

While these savings are not immediately apparent, they must be placed in context to grasp their value. The increased student body and increased utilization rate of facilities has an immediate impact on maintenance costs and personnel costs. For the maintenance of capital facilities (buildings, classrooms, etc.), the cost basis upon which these activities are spread has now increased, reducing the apparent cost to the institution of their maintenance. The impact is perhaps greater in the area of tenured professors. Tenured professors are typically not released under normal circumstances, even in times of enrollment fall-offs or contractionary budgetary environments. By increasing the output base across which the cost of these salaries is spread, unit production costs are thereby

reduced, which may free up funds to be utilized elsewhere. A discussion of some of the intangible benefits of this factor will be discussed at the end of this chapter.

Additionally, the use of this excess capacity can be looked at as an opportunity cost to the college by isolating that consideration to simple revenue generated. The maintenance of the excess capacity is a necessary evil for the institution, as it is for most businesses. However, that excess capacity is not without a real cost. In effect, there are twenty-three per cent of the total units that could be produced that are not generating any sales revenue. The increase of twenty-five students in the CS/IT department would mean an increase of 8%. Multiplying the number of students attending a single site times the estimated value of tuition and charges per student hour, shows an additional $67,625 in sales revenue that could be generated by the utilization of this excess capacity. The reverse, however, is also true. By not using this excess capacity, the college is incurring an opportunity cost in real dollars equal to the same amount.

D. POSSIBLE COST DISADVANTAGES TO THE INSTITUTION FROM PROGRAM ENROLLMENT

All that glitters is not gold however. The college stands to lose, as well, if consideration is not given to the economic factors that work against them in hosting this type of program. These losses come from accounting differences for resident and non-resident students and the possibility of fluctuations in inflation rate. While it is difficult to determine exactly how much these incurred expenses might offset any possible cost savings to be captured, a review of their possible impact is essential.

1. Residential Versus Non-Residential Enrollments

Total operational costs of the institution are allocated to SCHs per unit of time measure as a means of output for the college. There is no differentiation between a residential student, and a non-residential student. Since colleges charge different tuition rates for residential and non-residential students, there is an increased apparent cost to produce an SCH for a residential student. This is due to the fact that the residential students pay a lower tuition rate than the non-residents do. At the same time, there are typically more residential than non-residential students. The reality, however, is that it costs the school no more to produce a non-residential SCH than it does for

the school to produce a residential SCH. In this way, non-residential students actually subsidize a portion of the costs for educating the residential students [Ref.2]. If, in fact, costs were differentiated across the student credit hours, it would be seen that the cost to educate the non-residential students is actually less than the tuition they pay. The additional money they pay in tuition is the portion that goes to subsidize the educational costs of the residential student.

In almost every major institution across the country, the rates charged to military personnel for attendance at educational institutions is typically charged at the residential rate. In the case for OITU, the school will experience an increase in the residential student body of twenty-five, with no corresponding, offsetting, increase in the non-resident student body. This will, as stated previously, raise total costs. Because the students are all charged at the residential rates, this increase in used capacity will, in fact, cut into the amount that the non-residentials subsidize the residents' education. This will, in turn, raise the overall price of an enrollment at the college. This effect would be further exacerbated in a small community college.

2. Education Industry Inflation Effects

The final reason that the institution may fail to realize benefits from the contract is that the contract would likely lock them in to some set rates over a certain period of time. From the government's view, it will be necessary for the contract to establish service coverage of several cycles of graduates in order to ensure that the Navy has a steady source for this contract. This will also reduce a certain level of risk by eliminating the volatility inherent in a short term or single cycle contract. The risk to the institution however is significant. Their stake would be to ensure that the final price of the negotiated contract would cover sufficient inflation and devaluation of the dollar. This problem is not as simple as applying an assumed value for inflation however, due to the peculiar nature of the education industry itself.

Research shows that, historically, the increase in the cost of education outstrips the concurrent rate of inflation rise in the same time period. Between the years of 1961 and 1974, for example, inflation was 19.4% over the thirteen-year period, while the cost of education actually

doubled [Ref.8]. This higher rate of price increases is driven primarily by the increase in the cost of labor. Labor, in this case, refers to teachers qualified for the collegiate level.

As inflation increases, there is a concurrent rise in wages in order to keep up with the economy so that individuals can attempt to retain their buying power as the dollar devalues. The labor market for college educators is extremely competitive. Most individuals who are educated to a sufficient level to teach college level courses are also educated to a level capable of securing more lucrative forms of employment. In order for the education industry to retain these members of its labor market it must offer competitive salaries and increased benefits (such as tenure) to keep these persons from pursuing other lines of work [Ref. 8]. This constant attempt to "keep up with the Jones'", as far as wages are concerned, causes this increased rate of inflation specific to the education industry. Furthermore, this also means that the primary cost driver for an education service contract is the cost of the instructors labor.

To avoid a negative impact on the institution's profits due to OITU, the inflation rate applied to cover

costs of the program in the out-years must be set at a rate representative of the increased rate of inflation in the education industry. The most recent research of education industry cost increases shows that its rate was 9.65% over the four-year period from 1991 to 1994. The inflation rate during this time period was 8.81%[App.3]. While this is far less of a difference than the 1961-1974 period, Appendix Three shows that education costs tend to race far ahead of inflation during recessionary economic periods. Applying the 9.65% percent rise in costs evenly over the four years as a constant inflation rate, the OITU contract would result in the total four-year contract costs shown below:

Application of Education Industry Inflation Rate to Cost Estimations

School 1:	**Year 1**	**$22,970**
	Year 2	**$23,705**
	Year 3	**$24,440**
	Year 4	**$25,175**

Schools 2-6:	**Year 1**	**$2,705**
	Year 2	**$2,792**

Year 3 $2,879

Year 4 $2,965

E. CHAPTER III REVIEW

While it is difficult to at this point to determine exact values for these advantages and disadvantages, they must be taken into consideration by both the government and the contractors. Chapter IV will combine the findings for education, berthing, and subsistence from this chapter, with the additional travel costs determined in Chapter II. Already, it can be seen that the cost driver in an OITU program would shift from the cost of education to the cost for berthing. At the end of Chapter IV, this thesis will show what impact this has on the final comparison between ITU and OITU.

IV. COST COMPARISON

A. SIMILAR COSTS

Only two line items of cost data exist in each alternative that are essentially identical in heading. One is the cost of tuition and classes and the other is the cost for berthing or housing. Using the aggregate expected value for the OITU, that cost estimate is compared with the current charge to ITU of tuition and classes. From Formula 3-1 in Chapter III, the amounts estimated for total cost of education (classes and tuition) for the two OITU options were $22,970/student for School 1, and $2705/student for Schools 2 through 6. These amounts are now multiplied by student throughput and presented below:

Cost Comparison: Total Costs for Education

ITU Dam Neck (25 Students)	**$72,200 [App. 1]**
OITU (School 1)(100 Students)	**$2,297,000**
OITU(Schools 2-6)(100 Students)	**$270,500**

Applying the requisite accelerated industry inflation rate determined at the end of Chapter III to the cost estimates gives a fair representation of what the increased

costs would be in the second and third year of the contract. These are compared against the current budget estimates for years two and three of ITU Dam Neck. The subject of who pays for books in any Navy education program is a matter of debate. At the Naval Academy, Midshipmen buy their own books, but the money used is from a Navy-funded supplies account given to each individual Midshipman upon induction. At the Naval Postgraduate School, students pay for their own books at the beginning of each quarter, but this purchase is later subsidized. Because there is no standard policy on book procurement from program-to-program, this value is removed from any cost estimations in this study. It is as likely that OITU students could be required to buy their own books as it is that the Navy would pay for them. As such, it is inappropriate to apply a cost advantage or disadvantage to any program due to the cost of books:

Table 4-1: Application of Education Industry Inflation Rate to Cost Comparison for Education Costs

Out-Years Cost Estimates	Year 2	Year 3
ITU Dam Neck(see note below)	161,383	254,758
OITU (School 1)(100 students)	2,370,500	2,444,000
OITU (Schools 2-6)(100 students)	279,200	287,900

{Table 4-1 Note: Student throughput in Year 2 at ITU Dam Neck will be 40 students. It will then increase to 60 students in Year 3}

An area in which the Navy and ITU Dam Neck should clearly have an advantage is in the incurred costs of berthing. Comparing the expected value of berthing/housing costs determined at the beginning of Chapter III versus the current rate charges for the BEQ at Dam Neck yields the following results:

Cost Comparison, Total Costs for Berthing

ITU Dam Neck(40 students)	**$46,070**
OITU(School 1)(100 students)	**$859,500**

OITU(Schools 2-6)(100 students) **$887,500**

Since the dining facility at Dam Neck is accessible to the students of ITU, there is a zero cost of subsistence, at least to the program manager of ITU Dam Neck. This means that the cost of subsistence determined in Chapter III, is a relative higher cost. The totals for education, berthing, and subsistence for the twenty-five ITU Dam Neck students is shown below versus the costs for the one-hundred OITU students:

Cost Comparison, Total Costs for Education, Berthing, and Subsistence:

25 ITU Dam Neck Students:	**$118,270**
100 OITU(School1) Students:	**$3,468,200**
100 OITU(School2-6) Students:	**$1,469,700**

Clearly the costs of OITU are radically higher than ITU Dam Neck at this stage. It is worth mentioning, however, that were Dam Neck to provide the same throughput, its true costs would be:

Cost Estimate, ITU Dam Neck, 100 Student Throughput

100 ITU Dam Neck Students: $334,870

ITU Dam Necks' charged rate for the BEQ is a constant rate, regardless of class size, provided the class size remains within current constraints of the physical building. The one-hundred student size estimate shown above would not break these constraints. However, it is certain that this figure, for a 100-student class-size at Dam Neck ITU, is low because it does not reflect the likely need for the current service provider to hire additional labor to service so many students. Because actual salary information is not available, it is impossible to apply this labor charge to the above figure.

B. DISSIMILAR COSTS

The large difference in costs will be the charges incurred by the Navy to maintain its own infrastructure. Presented in Appendix Two, all of the material and infrastructure costs incurred by the Navy are a cost that would not be born directly in OITU. The costs incurred by ITU, which would not be incurred by OITU are presented and

totaled below. Because the money from Appendix One is already spent, the below estimates reflect costs that would not be incurred by OITU if it were commenced after the end of ITU Dam Neck's first year. Hence, these costs are from the FY01 estimates, summarized in Appendix Two:

ITU Dam Neck, Additional Costs:

Software, Hardware, and Install:	**$126,886**
Office:	**$8,655**
Consumables:	**$5,312**
Total:	**$140,853**

Assuming that ITU Dam Neck's costs for Software, Hardware and Install and Consumables would be multiplied by a factor of 2.5 (the factor that would increase CY01's class size from 40 to 100) were their throughput to increase to one hundred that year yields a higher cost for comparison to OITU. It is not appropriate to assume that there would be a concurrent increase in the cost of the Administration Offices, since it is possible that this number of students could be serviced with the same foundation of support. Applying the increased throughput factor to the above-mentioned line items yields:

ITU Dam Neck, Estimation of Additional Costs at 100 Student Throughput:

Software, Hardware, and Install (100 students):	**$317,215**
Consumables (100 students):	**$13,280**
Total (plus Office expense):	**$339,150**

C. COST COMPARISON TOTALS

The comparative costs of the programs are presented below:

Table 4-2: Final Cost Comparison, Total Costs, and Estimated Costs of 100 Student Throughput at ITU Dam Neck

Total 1-Year (Year 2) Cost Comparison	Cost	Cost Plus Commercial Travel
ITU Dam Neck(40 students)	348,306	348,306 (+29,942)
OITU(School 1)(100 students)	3,598,922	3,632,178
OITU(Schools 2-6)(100 students)	1,478,400	1,511,656
ITU Dam Neck (100 Student Throughput)	674,020	674,020

D. CHAPTER IV REVIEW

At face value, it appears that the costs to outsource ITU 100% would far outstrip the current costs of Dam Neck ITU. The issue at stake is throughput. At its current level, ITU Dam Neck's throughput is insufficient to meet fleet needs. It is not a solution that meets requirements *now*. There is no argument that can be presented by the figures found here to say this is not the right answer in the long-term. While estimations of the costs for a 100-student output are shown here for ITU Dam Neck, the author believes these figures are low, and therefore it may not actually cost an additional $837,600 (OITU Schools 2-6 Option versus ITU at a 100 student throughput) to train 75 additional, AAS-level IT's. This gap may be much less if additional costs, particularly any cost associated with the current service provider hiring more instructor labor, are not captured in these estimates. Chapter V will provide further conclusions and recommendations.

V. CONCLUSIONS AND RECOMMENDATIONS

While the findings in this thesis will provide a basis for further analysis they are by no means conclusive. It is difficult to capture all of the issues, in particular the intangibles, which may increase or decrease the real total costs of this program in either its present form or if outsourced. A discussion of some of those intangibles follows. Each of these intangibles represents areas in which further work on this topic could and/or should be conducted in order to complete a cost study of this issue in which *all* of the variables are considered. These issues, while pertinent to a full cost estimation, are outlying factors to an initial cost estimate, and truly could be thesis projects in and of themselves. As such, they were deemed beyond the scope of this singular work and present questions that still have to be answered.

A. LENGTH OF THE DEGREE PROGRAM

Perhaps the most significant issue not included in the cost estimates is the factor of time. There is no doubt that sixty-three semester hours of college-level work can be achieved in a twelve-month time-span. In order to accomplish this at a civilian university running on the

semester system (with a summer session), the students would have to take twenty-one credit hours a semester. The likelihood of one hundred per cent successful matriculation of such a program is highly unlikely. More importantly, the service provider may be pushed to hire additional personnel in order to handle such a high student load, as the number of sections of various classes would surely have to increase. This increase in personnel cost would shatter the premise on which these cost estimates were made. It is more likely that it would be necessary to lower the student load to a more reasonable sixteen credit hours a semester, with the final semester having only fifteen semester credit hours. This new, time-encompassing, cost estimate would have to cover possible differences in costs based on exactly what semesters in question were covered. This study made the assumption that the cost for any one particular semester was the same across the entire year. However, it is possible that cost during the summer semester are different due to changes in student volume, teacher leave periods, etc. An additional question would be how the total OITU student cycle would then change, if at all. Would it now start the next cycle of OITU students every four semesters vice every three, and if so, how does that affect

total throughput in the long run? Or does it make more sense to have overlapping cycles, having the next OITU class start its first semester during the preceding OITU class' last? What impact would either of these decisions have on the service provider and would either choice have a significant impact on cost?

B. INTERNAL RATE OF RETURN ON HUMAN CAPITAL

Another aspect of possible impact on total realized costs is our current investment in ITU. Since five of the students in each class are immediately recycled to be the next ITU mentors and teacher assistants , there is a partial "payback" factor to the program. A newspaper company would do a cost-benefit analysis of buying a new printing press based on the benefits of producing more papers versus the cost of the initial capital investment in the press. In a like vein, these five students per cycle represent an investment in human capital that should show a direct cost savings in future ITU iterations. In fact, it is quite possible that, were this area to become a core competency of the Navy, that it could eventually take over all instructor functions at ITU with active-duty military instructors only. It is difficult to speculate what costs

would be incurred in getting such a program accredited to award an Associate's Degree, and perhaps more importantly what costs would be required to keep it accredited and maintain an academic proficiency and *currency* in its teaching staff requisite with fulfilling the needs of the fleet. Determining how exactly to value human capital would begin with a simple evaluation in savings in labor costs. However, answering these further questions would require a much wider survey of various cost factors.

C. CORE COMPETENCIES

The subject of core competencies brings up another issue of cost not pursued in the scope of this work. In the view of core competencies, one of the tenants is that, in investing in an operation which is not directly in the nature of your organization, there is an increased cost beyond what is on the balance sheet because your resources could have been directed to an area which is your core competency. Supposedly these core competencies are the areas which provide you your biggest "bang for the buck", your greatest profit margin. While this view is not always applicable to the public sector, there is an argument that can be made that ITU Dam Neck is actually costing the Navy

more in resource efficiency because the Navy is not in the business of producing associate degree students. This is the core competency of an educational institution. An educational institution is an organization that can execute this function with the greatest efficiency and effectiveness. Yet, the previous paragraph indicates there is a possibility that Information Technology, with its great impact on the way in which the military and the Navy, in particular, does business and more importantly, fights wars is so important that it should become one of our core competencies and furthermore that the education of those who maintain that proficiency should be a core competency as well. As our expertise in this field grows, this argument may eventually become a valid one, but it would have to mean that our knowledge, experience, and application of this area of study advance to become at least on a par with our civilian counterparts, which is, as of now, clearly not the case. We would not think to send enlisted nuclear candidates to a civilian school for training. It is a core competency of the Navy's, and the Navy provides its functional area execution and operation, as well as the education of those who conduct it. The question here is what is the cost of such strategic path,

and could our investment in ITU be looked at from the point of view of an investment rate with an internal rate of return.

D. RECOMMENDATIONS FOR FURTHER STUDY

In conclusion, it is recommended that further study be conducted in the area of the cost of increasing the throughput of ITU. Current rates do not seem sufficient to meet fleet and shore establishment requirements. If it is found that the cost to increase our throughput via ITU is actually less expensive than outsourcing, these throughput levels should then be increased. While ITU is clearly the less expensive method at a low production rate, the figures show this may not be the case when throughput is increased. Consider that the difference between Year 2 projections for ITU and OITU(Schools 2-6) option show that the Navy would spend an additional $11,168 per student to increase throughput to one hundred.

Possibly the right answer is to continue with ITU, but send one of the groups of twenty currently set to attend ITU to an OITU for one cycle and compare final cost data. It is also likely that cost saving innovations not

discussed in this thesis could further reduce the costs of such a program. Sending sailors to sites near their first sea duty PCS (San Diego or Norfolk) for example, could minimize PCS costs for the Navy to an extent that would be beneficial and justify the increased costs. It might also be possible to select civilian sites that are located within distance of military berthing and the program could lease berthing space from either a Naval or other service military installation that would reduce the costs of housing. If this OITU turns out to be less expensive to the Navy and further innovations in its suggested implementation are realized, then the benefits of taking the risk may well become acceptable.

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APPENDIX A

ITU-00 Tuition Costs = $72,200

- Provide an AAS degree program in IST: Specialization--Windows NT.
  - Beginning March 13, 2000 and concluding March 9, 2001.
  - For a total of 63 semester credits to be delivered in a 12 month period.
  - The cost is per credit hour of instruction per student, of $45.84.

I. Complete IT-21 Computer Laboratory Install and Configuration = $277,515.00

- NAWCTSD estimate of $200,000.00 plus the following additional software install requirements:

Windows NT Server 4.0 licenses	26	$406.91	$10,579.66
Windows NT Server 4.0 media	1	$18.00	$18.00
Windows NT W/S 4.0 licenses	26	$158.38	$4,117.88
Windows NT W/S 4.0 media	1	$18.00	$18.00
MS Exchange Server 5.5 licenses	26	$306.27	$7,963.02
MS Exchange Server 5.5 media	1	$20.00	$20.00
Proxy Server 2.0 licenses	26	$477.94	$12,426.44
Proxy Server 2.0 media	1	$21.00	$21.00
MS Office 2000 licenses	26	$285.27	$7,417.02
MS Office 2000 media	1	$18.00	$18.00
Turbo C++	26	$40.00	$1,040.00
Oracle 8I (NT Version)	26	$1,301.00	$33,826.00
Mandrake software(shareware, copy will be provided by TidewaterCC, only cost is to burn CDS)	26		$50.00
TOTAL:			$77,515.02

II. Laboratory upgrade configuration costs = $52,000

(These are the physical equipment and material the costs to upgrade and wire the lab using existing 25 desktop PIII computers)

Hardware:

NT Server (Compaq)(PIII 500 Mhz, 2 9.4GB Hard Drives, 256 MB RAM, NT Server 4.0)	1	$2,023.00	$2,023.00

Gateway PC (instructor W/S- PII 350 Mhz, 3GB Hard Drive, 128 MB RAM, NIC, Video Card, Audio Card, Speakers, 3 ½" Floppy, CD-Drive, monitor, Windows 95)	1	$1,568.00	$1,568.00
Removable IDE Hard Drives 8GB (25 students,1 instructor, 1 spare)	27	$114.00	$3,078.00
IDE Frame Carriers (52 carriers, 26 frames)	52	$142.00	$7,384.00
8-Port Hubs	4	$180.00	$720.00
Laserjet Printer HP4050	1	$1,398.00	$1,398.00
Color Printer w/ spare set of ink cartridges	1	$942.00	$942.00
Proxima 9250+ projector	1	$6,665.00	$6,665.00
UPS (for server)	1	$277.00	$277.00
19" Equipment racks	2	$0.00	$0.00
Cabling (Cat 5) 1000'	1	$120.00	$120.00
Cable Connectors (RJ-45)	100	$.50	$50.00
TOTAL:			$24,225.00

Software:

Windows NT Server 4.0 licenses	26	$406.91	$10,579.66
Windows NT Server 4.0 media	1	$18.00	$18.00
Windows NT W/S 4.0 licenses	26	$158.38	$4,117.88
Windows NT W/S 4.0 media	1	$18.00	$18.00
MS Exchange Server 5.5 licenses	26	$306.27	$7,963.02
MS Exchange Server 5.5 media	1	$20.00	$20.00
Proxy Server 2.0 licenses	26	$477.94	$12,426.44
Proxy Server 2.0 media	1	$21.00	$21.00
MS Office 2000 Upgrade licenses from Office 97	25	$204.76	$5,119.00
MS Office 2000 new license	1	$285.27	$285.27
MS Office 2000 media	1	$18.00	$18.00
Turbo C++	26	$40.00	$1,040.00
Oracle 8I (NT Version)	26	$1,301.00	$33,826.00
Mandrake software(shareware, copy will be provided by TidewaterCC, only cost is to burn CDS)	26		$50.00
Totals:			$75,502.27

III. Mentor's LapTop Computer (5 ea.) Specs and Estimated Cost = $13,500 (2700.00 ea)

**** Note: Based upon government contract rates as published on their web site.

- Specs:
  - P-III 433 Celerons
  - NIC/Modem
  - 6 GB HD
  - 3.5 Floppy
  - 24X CD ROM
  - Office 2000
  - MS NT WS 4.0 OS
  - 15" SVGA Active Matrix display
  - 8MB Video Memory
  - Nylon Carrying Case
  - 64 MB SDRAM

IV. Student Administrative Computers (20 ea.) Specs and Estimated Cost = $24,000 ($2,000.00 ea.)

**** Note: Based upon government contract rates as published on their web site.

- Specs:
  - P-III 500
  - NIC (10/100)
  - Modem
  - 18 GB HD
  - 3.5 Floppy
  - 24X CD ROM
  - Office 2000
  - MS NT WS 4.0 OS
  - 17" Monitor
  - 8MB Video Memory
  - 64 MB SDRAM

V. Connect BEQ to FCTCL LAN = $35,000.00

VI. Miscellaneous Support Costs = $7,500.00 (estimate $300.00 per student per year)

VII. Student Costs = $4,25.00 ($165.00 ea.)

VIII. Book Costs = $ 1000 per student / $25K per class

**** Note: using the higher of the researched prices for each book.

A. ENG 111 English Composition
   1) Little, Brown Compact Handbook (Incl. 1998 MLA)
      a. Aaron
      b. 1998, 3rd edition
      c. Addison-Wesley Publishing Co.
      d. 0-321-03796-0
      e. Cost @ amazon.com $35.15
      f. Cost @ Barnes and Noble - $35.15
   2) Reasoning and Writing Well
      a. Dietsch
      b. 1998, 1st edition
      c. Mayfield Publishing Co.
      d. 1-55934-953-0
      e. Cost @ amazon.com $36.95
      f. Cost @ Barnes and Noble - $55.01

B. IST 114: Fundamentals of CIS
   1) Computer Tools for an Information Age
      a. Capron
      b. 6th Edition
      c. Prentice Hall
      d. 0-201-47659-2
      e. Cost @ amazon.com $62.85
      f. Cost @ Barnes and Noble – Not Available
   2) The Beginner's Guide to C
      a. Horton
      b. 1994
      c. WROX publishing
      d. 1-874416-15-X
      e. Cost @ www.wrox.com - $27.95
      f. Cost @ amazon.com – Not Available
      g. Cost @ Barnes and Noble - Not Available

C. IST 117: Intro to Microcomputer Software
   1) New Perspectives on Office 2000
      a. Parsons
      b. 1999
      c. Course Technology
      d. 0-7600-6961-1
      e. Cost @ amazon.com – $57.75
      f. Cost @ Barnes and Noble - $57.75

D. IST 106:
   1) Windows User's Guide to DOS: Using 95/98
      a. Gillay
      b. 1999
      c. Franklin, Beedle & Associates
      d. 1-887902-42-2
      e. Cost @ amazon.com – $44.95
      f. Cost @ Barnes and Noble - $47.75
   2) New Perspectives on Microsoft Windows 95 - Comprehensive
      a. Parsons
      b. 1997
      c. Course Technology
      d. 1-56527-998-0
      e. Cost @ amazon.com – $44.75
      f. Cost @ Barnes and Noble – Not Available

E. IST 193: Networking Essentials; IST 193, NT Workstation; IST 193, NT Server; IST 293, NT Server in the Enterprise
   1) MCSE Core Requirements
      a. Chellis
      b. SYBEX
      c. 0-7821-2245-0
      d. Cost @ readmedoc.com - $100.47
      e. Cost @ amazon.com – $104.97

NOTE: All in one package.
Networking Essentials, NT Workstation, NT Server, NT Enterprise

F. MTH 158: College Algebra
   Algebra for College Students (shrink wrapped w/ solution manual)
      a. Lial, Hornsby, and Miller
      b. 1996, 3rd Edition
      c. Addison-Wesley Publishing Co.
      d. 0-321-01605-X

e. Cost @ amazon.com – $79.00
f. Cost @ Barnes and Noble - $85.75

G. IST 133 Database: Oracle
A Guide to Oracle 8
a. Morrison
b. Course Technology
c. 0-619-00027-9
d. Cost @ amazon.com – $66.95
e. Cost @ Barnes and Noble - $47.75

H. IST 109: UNIX
1) UNIX in a Nutshell: System V
a. Arnold Robbins
b. O'Reilly and Associates
c. 3rd Edition
d. 1-56592-427-4
e. Cost @ ora.com - $24.95
f. Cost @ amazon.com – $XX.XX
g. Cost @ Barnes and Noble - $19.96

2) Practical Guide to the UNIX System
a. Sobell
b. Addison-Wesley-Long
c. 3rd Edition
d. 0-80537-565-1
e. Cost @ awl.com - $62.95
f. Cost @ amazon.com – $XX.XX
g. Cost @ Barnes and Noble - $38.44

I. IST 293: NT Proxy Server:
Proxy Server
a. Rozell/Lammle
b. SYBEX
c. 0-7821-2194-2
d. Cost @ readmedoc.com - $33.49
e. Cost @ amazon.com – $XX.XX
f. Cost @ Barnes and Noble - $34.99

J. SPD 100: Public Speaking
1) Art of Public Speaking
a. Lucas
b. 1998, 6th edition
c. McGraw-Hill Book Company

d. 0-07-235-738-X
e. Cost @ amazon.com – $50.45
f. Cost @ Barnes and Noble - $50.45

K. GEO 210: Geography
1) New Comparative World Atlas
a. Hammond
b. Hammond Inc.
c. 1998
d. 0-8437-7100-3
e. Cost @ amazon.com – $10.95
f. Cost @ Barnes and Noble - $10.95
2) Cultural Landscape: Intro to Human Geography
a. Rubenstein
b. Prentice Hall Inc.
c. 1999, 6th edition
d. 0-13-079778-2
e. Cost @ amazon.com – $77.75
f. Cost @ Barnes and Noble – Not Available

L. IST 295: Windows NT: Exchange Server
1) Exchange Server 5.5
a. Easlick/Chellis
b. SYBEX
c. 0-7821-2261-2
d. Cost @ readmedoc.com - $33.49
e. Cost @ amazon.com – $34.99
f. Cost @ Barnes and Noble - $39.99

M. IST 195: Intro – CISCO
1) CCNA Exam Certification Guide
a. Wendell Odom
b. Cisco Press
c. Feb 99
d. 0-7357-007307
e. Cost @ ciscopress.com - $60.00
f. Cost @ amazon.com – Not Available
g. Cost @ Barnes and Noble - $60.00

N. NT Elective (TBD) – Estimated cost ≈ $49.00

IX. Contractor - Subject Matter Expert (SME) = $80K per one man-year

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APPENDIX B

Date: March 29, 2000

Subj: Cost out to convene IT University in Mar 2001

Encl: (1) Detailed IT University Expenses

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1. The FY-01/02 IT University cost out figures are based upon the following assumptions:

   a. In accordance with the IT University TPP
      1) There will be two classes of 20 students each (40 total students) from March 2001 through March 2002.
      2) There will be three classess of 20 students each (60 total students) from March 2002 through March 2003.

   b. General Education textbooks will not need replacing for one of the classes convening March 2001.
      1) FY-02 convenings will likely need GenEd textbook updates.

   c. Estimates for Active Duty Course Supervisor and continued Mentor support costs not included.

   d. TCC will bear software costs, as they have for FY00 convening.
      1) MS Windows NT Upgrade to MS Windows 2000 does not require funding.
      2) MS Office 2000 will not require upgrade.

2. The following totals (supported by enclosure (1), represent complete cost out for:

   a. FY 01 (March 2001 through March 2002) convenings.

Software, Hardware, and Install -	**$126,886.00**
Books and Tuition	**$187,200.00**
Office	**$8,655.00**
BEQ	**$46,070.00**
Consumables	**$5,312.20**
TOTAL	**$374,123.20**

   b. FY-02 (March 2002 through March 2003) convenings.

Software, Hardware, and Install -	**$122,100.30**
Books and Tuition	**$304,605.00**
Office	**$400.00**
BEQ	**$44,638.50**
Consumables	**$7,813.37**
TOTAL	**$479,557.17**

June 20, 2000

IT UNIVERSITY

FY-01 Classroom and Lab Hardware/Software

ITEM	Unit Cost	Quantity	Upgrade Current Lab - Room 340	Quantity	Upgrade Current Classroom- Room 333		Quantity	New Lab-Rm 343	Quantity	New Classroom- Rm 341
Carriers	$35.00						21	$735.00		
Carriers w/Frames	$65.00						21	$1,365.00		
Cart-Roll around	$160.00								1	$160.00
Computer Rack-19"	$8,000.00						1	$8,000.00		
Computer-Instructor/Lab & Classroom	$1,600.00						1	$1,600.00	1	$1,600.00
Computer-Student/Lab	$2,000.00						20	$40,000.00		
Computer-Server	$3,000.00						1	$3,000.00		
Computer-Server Monitor	$435.00						1	$435.00		
Construction - False Wall & Door (341/342)	$8,000.00								1	$8,000.00
Furniture-Bookshelves	$200.00						1	$200.00	3	$600.00
Furniture-Classroom Tables	$200.00								11	$2,200.00
Furniture-Lab and Classroom Chairs	$100.00						21	$2,100.00	21	$2,100.00
Furniture-Lab Desk	$300.00						21	$6,300.00		
Hard Drives-8.4G	$110.00						22	$2,420.00		
Lab Installation Cost (Labor/Power/Cabling)	$20,000.00						1	$20,000.00		
Internet Connectivity-Lab	$3,000.00						1	$3,000.00		
Printer-Deskjet	$400.00						1	$400.00	1	$400.00
Printer-DeskJet/BEQ	$400.00								1	$400.00
Printer-HP Laserjet	$1,500.00						1	$1,500.00		
Projection Screen	$800.00						1	$800.00	1	$800.00
Projector	$5,250.00						1	$5,250.00	1	$5,250.00
Projector-Split screen cable with amplifier	$1,100.00						1	$1,100.00		
Software-Windows 98 Upgrade	$100.00	26	$2,600.00							
Surge Protectors	$6.00						21	$126.00		
Switches-Cisco Catalyst 2900 Series	$3,000.00						1	$3,000.00		
UPS	$645.00						1	$645.00		
VAP Board-Class & Lab	$400.00						1	$400.00	1	$400.00
	Totals		**$2,600.00**					**$102,376.00**		**$21,910.00**

CLASSROOM AND LAB HARD/SOFTWARE AND INSTALL (FY-01) = $126,886.00

Tuition (Yearly cost: Mar 00-Mar 01)	$71,200.00			1	$71,200.00				1	$71,200.00
Books-GenEd	$6,200.00								1	$6,200.00
Books-Technical	$19,300.00			1	$19,300.00				1	$19,300.00
	Totals				**$90,500.00**					**$96,700.00**

TUITION AND BOOKS TOTAL (FY-01) = $187,200.00

June 20, 2000

IT UNIVERSITY

FY-02 Classroom and Lab Hardware/Software

ITEM	Unit Cost	Quantity	Upgrade Class #1 LAB and Classroom - Room 340/333 (Cost Plus 5%)	Quantity	Upgrade Class # 2 LAB and Classroom- Rooms 341/343 (Cost Plus 5%)	Quantity	New Lab for Class #3-UNK Room number (Cost Plus 5%)	Quantity	New Classroom for Class #3-UNK Room number (Cost Plus 5%)
Carriers	$35.00					21	$771.75		
Carriers w/Frames	$65.00					21	$1,433.25		
Cart-Roll around	$160.00							1	$168.00
Computer Rack-19"	$8,000.00					1	$8,400.00		
Computer-Instructor/Lab & Classroom	$1,600.00					1	$1,680.00	1	$1,680.00
Computer-Student/Lab	$2,000.00					20	$42,000.00		
Computer-Server	$3,000.00					1	$3,150.00		
Computer-Server Monitor	$435.00					1	$456.75		
Furniture-Bookshelves	$200.00					1	$210.00	3	$630.00
Furniture-Classroom Tables	$200.00							11	$2,310.00
Furniture-Lab and Classroom Chairs	$100.00					21	$2,205.00	21	$2,205.00
Furniture-Lab Desk	$300.00					21	$6,615.00		
Hard Drives-8.4G	$110.00					22	$2,541.00		
Lab Installation Cost (Labor/Power/Cabling)	$20,000.00					1	$21,000.00		
Internet Connectivity-Lab	$3,000.00					1	$3,150.00		
Printer-Deskjet	$400.00					1	$420.00	1	$420.00
Printer-DeskJet/BEQ	$400.00							1	$420.00
Printer-HP Laserjet	$1,500.00					1	$1,575.00		
Projection Screen	$800.00					1	$840.00	1	$840.00
Projector	$5,250.00					1	$5,512.50	1	$5,512.50
Projector-Split screen cable with amplifier	$1,100.00					1	$1,155.00		
Surge Protectors	$6.00					21	$132.30		
Switches-Cisco Catalyst 2900 Series	$3,000.00					1	$3,150.00		
UPS	$645.00					1	$677.25		
VAP Board-Class & Lab	$400.00					1	$420.00	1	$420.00
	Totals						**$107,494.80**		**$14,605.50**

CLASSROOM AND LAB HARD/SOFTWARE AND INSTALL (FY-02) = $122,100.30

Tuition: MAR02 - MAR03)	$71,200.00	1	$74,760.00	1	$74,760.00			1	$74,760.00
Books-GenEd	$6,200.00	1	$6,510.00	1	$6,510.00			1	$6,510.00
Books-Technical	$19,300.00	1	$20,265.00	1	$20,265.00			1	$20,265.00
	Totals		**$101,535.00**		**$101,535.00**				**$101,535.00**

TUITION AND BOOKS TOTAL (FY-02) = $304,605.00

IT University Comsumables and Misc Expenses

FY-01 Cost Estimates

Consumables

		Quantity	Upgrade Current Classroom- Room 333		Quantity	New Classroom- Rm 341
Calculators	$25.00				20	$500.00
Flowchart Templates	$2.70				20	$54.00
Thesaurus	$16.00				20	$320.00
Dictionary	$16.00				20	$320.00
Corkboard	$17.00				2	$34.00
CD-R (Box of 100)	$50.00	2	$100.00		2	$100.00
Diskettes (Box of 25)	$8.00	10	$80.00		10	$80.00
Print Catridge - DeskJet Color	$30.00	2			2	
Print Cartridges - Laser (Lab/)BEQ	$75.00	10	$750.00		10	$750.00
Print Cartridges - DeskJet - Black	$30.00	2	$60.00		2	$60.00
Notebooks-200 sheet	$1.50	240	$360.00		240	$360.00
Tool Kits	$20.00					
Folders (Box of 25)	$7.35	10	$73.50		10	$73.50
Paper (Box)	$31.50	12	$378.00		12	$378.00
Envelopes (Box of 100)	$10.00	2	$20.00		2	$20.00
Pencils (Box of 50)	$10.00	1	$10.00		1	$10.00
Pens (Box of 50)	$14.00	1	$14.00		1	$14.00
Pencils-Mechanical (Box of 25)	$65.00	1	$65.00		1	$65.00
Highlighters (Per 50)	$10.00	1	$10.00		1	$10.00
Markers-VAP Board (Per set)	$6.55	2	$13.10		2	$13.10
Markers-Permanent	$0.31	50	$15.50		50	$15.50
Wastebaskets	$9.50				2	$19.00
Binders	$2.35				20	$47.00
Disk Holders	$5.00				20	$100.00
Disk Holders	$10.00				2	$20.00
Total			**$1,949.10**			**$3,363.10**

TOTAL OF ALL CONSUMABLES = $5,312.20

Office Resources Requirements

	Unit Cost	Quantity	Office Room 342
Office-Furniture-File Cabinet	$455.00	1	$455.00
Office-BookShelf	$200.00	1	$200.00
Office-Chairs	$100.00	4	$400.00
Office-Desks	$300.00	4	$1,200.00
Print Cartridges	$100.00	4	$400.00
Document Center	$6,000.00	1	$6,000.00
Total			**$8,655.00**

BEQ

	Unit Cost	Quantity	
Surge Protectors	$6.00	20	$120.00
Computer-Students Admin	$2,000.00	20	$40,000.00
Software-Win 98 Upgrade	$100.00	20	$2,000.00
Print Cartridges - Laser	$75.00	6	$450.00
BEQ Computer Security Hardware	$87.50	40	$3,500.00
Total			**$46,070.00**

FY-02 Cost Estimates

Consumables

		Quantity	Upgrade Current Classroom- Room 333 (Cost Plus 5%)		Quantity	Upgrade second Classroom- Rm 341(Cost Plus 5%)		Quantity	New Classroom-UNK Room Number (Cost Plus 5%)
Calculators	$25.00							20	$525.00
Flowchart Templates	$2.70							20	$56.70
Thesaurus	$16.00							20	$336.00
Dictionary	$16.00							20	$336.00
Corkboard	$17.00							2	$35.70
CD-R (Box of 100)	$50.00	2	$105.00		2	$105.00		2	$105.00
Diskettes (Box of 25)	$8.00	10	$84.00		10	$84.00		10	$84.00
Print Cartridges - Laser	$75.00	10	$787.50		10	$787.50		10	$787.50
Print Cartridges - DeskJet - Color	$30.00	2	$63.00		2	$63.00		2	$63.00
Print Cartridges - DeskJet - B/W	$30.00	2	$63.00		2	$63.00		2	$63.00
Notebooks-200 sheet	$1.50	240	$378.00		240	$378.00		240	$378.00
Tool Kits	$20.00								
Folders (Box of 25)	$7.35	10	$77.18		10	$77.18		10	$77.18
Paper (Box)	$31.50	12	$396.90		12	$396.90		12	$396.90
Envelopes (Box of 100)	$10.00	2	$21.00		2	$21.00		2	$21.00
Pencils (Box of 50)	$10.00	1	$10.50		1	$10.50		1	$10.50
Pens (Box of 50)	$14.00	1	$14.70		1	$14.70		1	$14.70
Pencils-Mechanical (Box of 25)	$65.00	1	$68.25		1	$68.25		1	$68.25
Highlighters (Per 50)	$10.00	1	$10.50		1	$10.50		1	$10.50
Markers-VAP Board (Per set)	$6.55	2	$13.76		2	$13.76		2	$13.76
Markers-Permanent	$0.31	50	$16.28		50	$16.28		50	$16.28
Wastebaskets	$9.50							2	$19.95
Binders	$2.35							20	$49.35
Disk Holders	$5.00							20	$105.00
Disk Holders	$10.00							2	$21.00
	Total		**$2,109.56**			**$2,109.56**			**$3,594.26**

TOTAL OF ALL CONSUMABLES = $7,813.37

Office Resource Requirements

	Unit Cost	Quantity	Office Room 342
Print Cartridges - Laser	$100.00	4	$400.00
Total			**$400.00**

FY-02 BEQ cost estimates

	Unit Cost	Quantity	Cost (Plus 5%)
Surge Protectors	$6.00	20	$126.00
Computer-Students Admin	$2,000.00	20	$42,000.00
Print Cartridge - Laser	$75.00	9	$675.00
BEQ Computer Security	$87.50	20	$1,837.50
Total			**$44,638.50**

BOOKS for IT University (FY-01)

General Education Books

Title	Unit Cost	CLASS #1 Quantity	CLASS #2 Quantity	Total Cost
Little Brown Compact Book	$29.75		20	$595.00
Reasoning and Writing Well	$33.55		20	$671.00
Art of Public Speaking	$43.17		20	$863.40
The Drama of Democracy	$48.12		20	$962.40
Cultural Landscape: An Introduction to Human Geography	$65.33		20	$1,306.60
New Comparitive World Atlas	$10.46		20	$209.20
Mathematics: Its Power and Utility	$61.21		20	$1,224.20
TOTAL	**$291.59**	0	140	**$5,831.80**

Technical Books

Title	Unit Cost	CLASS #1 Quantity	CLASS #2 Quantity	Total Cost
Computers, Standard: Tools for an Information Age	$52.50	20	20	$2,100.00
The Beginners Guide to C	$16.30	20	20	$652.00
New Perspectives on Office 2000	$51.58	20	20	$2,063.20
Windows Users Guide to DOS	$41.94	20	20	$1,677.60
New Perspectives on Microsoft Windows 95	$41.95	20	20	$1,678.00
A Guide to ORACLE 8I	$45.68	20	20	$1,827.20
UNIX in a Nutshell	$17.46	20	20	$698.40
Practical Guide to the UNIX System	$26.92	20	20	$1,076.80
Proxy Server 2 Study Guide	$29.16	20	20	$1,166.40
Exchange Server 5.5 Study Guide	$29.16	20	20	$1,166.40
MCSE Core Requirements	$87.48	20	20	$3,499.20
CCNA Exam Certification Guide	$42.00	20	20	$1,680.00
The Drama of Democracy - Study Guide	$17.50	20	20	$700.00
TOTAL	**$499.63**	260	260	**$19,985.20**

TOTAL of all columns this sheet = $25,817.00

BOOKS for IT University (FY-02)

General Education Books (assumes all updated)

Title	Unit Cost	CLASS #1 Quantity	CLASS #2 Quantity	CLASS #3 Quantity	Total Cost (Plus 5%)
Little Brown Compact Book	$29.75	20	20	20	$1,874.25
Reasoning and Writing Well	$33.55	20	20	20	$2,113.65
Art of Public Speaking	$43.17	20	20	20	$2,719.71
The Drama of Democracy	$48.12	20	20	20	$3,031.56
Cultural Landscape: An Introduction to Human Geography	$65.33	20	20	20	$4,115.79
New Comparitive World Atlas	$10.46	20	20	20	$658.98
Mathematics: Its Power and Utility	$61.21	20	20	20	$3,856.23
TOTAL	**$291.59**	0	140	140	**$18,370.17**

Technical Books

Title	Unit Cost	CLASS #1 Quantity	CLASS #2 Quantity	CLASS #3 Quantity	Total Cost
Computers, Standard: Tools for an Information Age	$52.50	20	20	20	$3,307.50
The Beginners Guide to C	$16.30	20	20	20	$1,026.90
New Perspectives on Office 2000	$51.58	20	20	20	$3,249.54
Windows Users Guide to DOS	$41.94	20	20	20	$2,642.22
New Perspectives on Microsoft Windows 95	$41.95	20	20	20	$2,642.85
A Guide to ORACLE 8I	$45.68	20	20	20	$2,877.84
UNIX in a Nutshell	$17.46	20	20	20	$1,099.98
Practical Guide to the UNIX System	$26.92	20	20	20	$1,695.96
Proxy Server 2 Study Guide	$29.16	20	20	20	$1,837.08
Exchange Server 5.5 Study Guide	$29.16	20	20	20	$1,837.08
MCSE Core Requirements	$87.48	20	20	20	$5,511.24
CCNA Exam Certification Guide	$42.00	20	20	20	$2,646.00
The Drama of Democracy - Study Guide	$17.50	20	20	20	$1,102.50
TOTAL	**$499.63**	260	260	260	**$31,476.69**

TOTAL of all columns this sheet = $49,846.86

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APPENDIX C

Digest of Education Statistics 1997

Table 38.--Gross domestic product deflator, Consumer Price Index, education price indexes, and federal budget composite deflator: 1919 to 1997

Calendar year			School year					
Year	Gross domestic product chain weight deflator	Consumer Price Index\1\	Year	Consumer Price Index\2\	Elementary/ Secondary Price Index	Higher Education Price Index	Research and Development Index	A L Op
1	2	3	4	5	6	7	8	
1919 ...	---	17.3	1919-20	19.1	---	---	---	
1929 ...	---	17.1	1929-30	17.1	---	---	---	
1934 ...	---	13.4	1934-35	13.6	---	---	---	
1939 ...	---	13.9	1939-40	14.0	---	---	---	
1940 ...	---	14.0	1940-41	14.2	---	---	---	
1941 ...	---	14.7	1941-42	15.6	---	---	---	
1942 ...	---	16.3	1942-43	16.9	---	---	---	
1943 ...	---	17.3	1943-44	17.4	---	---	---	
1944 ...	---	17.6	1944-45	17.8	---	---	---	
1945 ...	---	18.0	1945-46	18.2	---	---	---	
1946 ...	---	19.5	1946-47	21.2	---	---	---	
1947 ...	---	22.3	1947-48	23.3	---	---	---	
1948 ...	---	24.1	1948-49	24.1	---	---	---	
1949 ...	---	23.8	1949-50	23.7	---	---	---	
1950 ...	---	24.1	1950-51	25.1	---	---	---	
1951 ...	---	26.0	1951-52	26.3	---	---	---	
1952 ...	---	26.5	1952-53	26.7	---	---	---	
1953 ...	---	26.7	1953-54	26.9	---	---	---	
1954 ...	---	26.9	1954-55	26.8	---	---	---	
1955 ...	---	26.8	1955-56	26.9	---	---	---	
1956 ...	---	27.2	1956-57	27.7	---	---	---	
1957 ...	---	28.1	1957-58	28.6	---	---	---	
1958 ...	---	28.9	1958-59	29.0	---	---	---	
1959 ...	23.0	29.1	1959-60	29.4	---	---	---	
1960 ...	23.3	29.6	1960-61	29.8	---	25.6	26.7	
1961 ...	23.6	29.9	1961-62	30.1	---	26.5	27.5	
1962 ...	23.9	30.2	1962-63	30.4	---	27.6	28.5	
1963 ...	24.2	30.6	1963-64	30.8	---	28.6	29.5	
1964 ...	24.6	31.0	1964-65	31.2	---	29.8	30.7	
1965 ...	25.0	31.5	1965-66	31.9	---	31.3	32.0	
1966 ...	25.7	32.4	1966-67	32.9	---	32.9	33.8	
1967 ...	26.6	33.4	1967-68	34.0	---	34.9	35.7	
1968 ...	27.7	34.8	1968-69	35.7	---	37.1	38.0	
1969 ...	29.0	36.7	1969-70	37.8	---	39.5	40.3	
1970 ...	30.6	38.8	1970-71	39.7	---	42.1	42.7	

1971 ...	32.1	40.5	1971-72	41.2	---	44.3	45.0
1972 ...	33.5	41.8	1972-73	42.8	---	46.7	47.1
1973 ...	35.4	44.4	1973-74	46.6	---	49.9	50.1
1974 ...	38.5	49.3	1974-75	51.8	52.7	54.3	54.8
1975 ...	42.2	53.8	1975-76	55.5	57.3	57.8	59.0
1976 ...	44.6	56.9	1976-77	58.7	60.9	61.5	62.7
1977 ...	47.5	60.6	1977-78	62.6	64.8	65.7	66.8
1978 ...	50.9	65.2	1978-79	68.5	70.5	70.5	71.7
1979 ...	55.3	72.6	1979-80	77.6	76.6	77.5	78.3
1980 ...	60.4	82.4	1980-81	86.6	85.9	85.8	86.6
1981 ...	66.1	90.9	1981-82	94.1	93.7	93.9	94.0
1982 ...	70.2	96.5	1982-83	98.2	100.0	100.0	100.0
1983 ...	73.2	99.6	1983-84	101.8	105.0	104.8	104.3
1984 ...	75.9	103.9	1984-85	105.8	112.0	110.8	109.8
1985 ...	78.6	107.6	1985-86	108.8	118.5	116.3	115.2
1986 ...	80.6	109.6	1986-87	111.2	123.3	120.9	120.0
1987 ...	83.1	113.6	1987-88	115.8	129.8	126.1	126.8
1988 ...	86.1	118.3	1988-89	121.2	136.3	132.8	132.1
1989 ...	89.7	124.0	1989-90	127.0	144.3	140.8	139.0
1990 ...	93.6	130.7	1990-91	133.9	152.3	148.2	145.8
1991 ...	97.3	136.2	1991-92	138.2	158.5	153.4	150.5
1992 ...	100.0	140.3	1992-93	142.5	162.2	157.9	155.2
1993 ...	102.6	144.5	1993-94	146.2	167.1	163.3	160.2
1994 ...	105.0	148.2	1994-95	150.4	170.6	168.2	165.4
1995 ...	107.6	152.4	1995-96	154.5	---	---	---
1996 ...	109.7	156.9	1996-97	158.9	---	---	---
1997 ...	---	---	1997-98	---	---	---	---

\1\Index for urban wage earners and clerical workers through 1977; 1978 and later figures are for all urban consumers.

\2\Consumer Price Index adjusted to a school-year basis (July through June).

---Data not available.

NOTE.--Some data have been revised from previously published figures.

SOURCE: Council of Economic Advisers, Economic Indicators, February 1991 and April 1997, and Economic Report of the President, February 1996; U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index; Research Associates of Washington, "Inflation Measures for Schools and Colleges, 1990 Update," and unpublished data; and U.S. Office of Management and Budget, Budget of the U.S. Government, Fiscal Year 1997. (This table was prepared June 1997.)

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